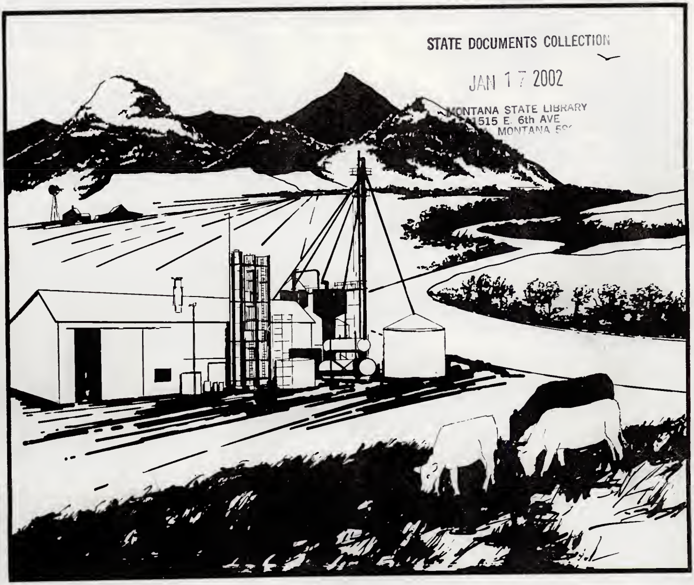
DIRECTORY OF MONTANA BIOMASS ENERGY FACILITIES



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DIRECTORY OF MONTANA
BIOMASS ENERGY FACILITIES
August, 1988

INTRODUCTION

This directory has been compiled for the benefit of those individuals working with or interested in the 36 bioenergy projects in Montana -- a fuel alcohol plant, 5 biogas digesters, 4 wood pellet plants, and 26 biomass combustion facilities. This work was funded by the U.S. Department of Energy's Pacific Northwest and Alaska Regional Bioenergy Program, The Bonneville Power Administration, and the Montana Department of Natural Resources and Conservation (DNRC).

This directory gathers information on existing, in-state biomass energy facilities to be used as examples to potential users in Montana. It includes descriptions of active facilities and some of those that are no longer operating. Some biomass energy companies or entities may have been inadvertently omitted because of the constant changes and the number of entities involved in biomass energy in Montana. The Energy Division of DNRC would appreciate hearing from any individual or company that this directory omits or lists incorrectly. Please address all correspondence to:

Biomass Program Engineer
Energy Division, DNRC
1520 East Sixth Avenue
Helena, Montana 59620-2301

METHODOLOGY

Several data bases were used to compile this directory, including the Montana Wood Products Industry Directory, the Department of Health and Environmental Sciences Air Quality Bureau's List of Registered Combustors, and DNRC's October

1987 Directory of Biomass Energy Facilities. Industries and organizations shown on these lists were contacted by telephone or by mail:

The list of regulated combustors from the Department of Health and Environmental Sciences Air Quality Bureau identified wood-fired combustors that have permits under the Montana Clean Air Act. The list was used to obtain the maximum fuel use in tons per hour and heat output in millions of Btus per hour defined as a function of fuel feed and boiler capacity. Boilers that produce less than 5 tons per year of particulate matter are not included on the list.

OVERVIEW OF PROJECTS

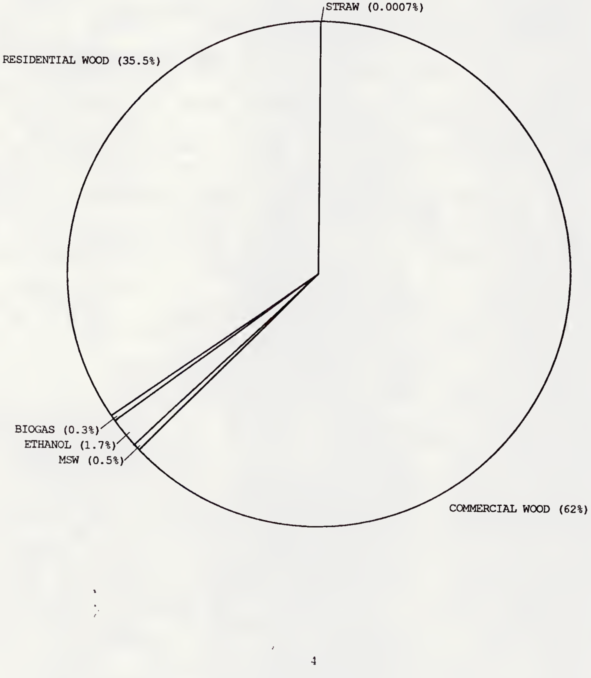
Biomass fuels displace 18,214,000 Btus of fossil fuel annually in Montana. The types of biomass used as energy include combustion of wood waste, municipal solid waste (MSW), straw, and biogas for industrial and residential heat; wood waste and biogas for cogeneration; and fuel ethanol for gasohol production. The relative use of energy by Btu content of biomass type is illustrated in Figure 1. The actual amounts of use, based on the response to this directory, are in Table 1.

Table 1
Annual Biomass Energy Use in Montana, August 1988

Biomass Type	Amount/Yr	Units	Millions of Btus/Year	Percent of Total Biomass Used, Btu Basis
Commercial Wood	644,000	Dry Tons	11,288,000	61.99
Residential Wood	380,000	Dry Tons	6,460.000	35.46
Fuel Ethanol	3,650,000 (12	Anhydrous gallons Tons)	308,060	1.69
MSW	6,160	Tons	99,150	0.54
Biogas	96,700,000 (1,500	Cubic Feet Tons)	58,987	0.32
Straw	9	Tons	120	0.0007
TOTAL	1,032,000	Tons	18,214,317	100.00

FIGURE 1. RELATIVE USE OF BIOMASS FUELS

BASED ON ENERGY CONTENT



Waste Wood and Pellet Facilities

Facilities using waste wood fuel in Montana account for 62 percent of the consumed biomass Btus. Twenty-two of the 31 facilities burning wood fuel were related to the wood products industry. The remaining wood-fired combustors were located in institutions or schools (4), wood pellet processing plants (4), and at an ethanol fuel facility. Roughly 42 percent of the wood-fired boilers were owned by corporations, 45 percent by individuals or private companies, and 13 percent by public entities or tribes.

Approximately 664,000 oven-dry tons of wood waste are used for fuel each year by these institutional, commercial, or industrial operations. For example, a plywood manufacturing plant burns sawdust from the sanding operations while the smaller mills burn hogged fuel consisting of waste wood, bark, or the ends of dimension lumber. None of the facilities co-fired wood and coal. All of the steam produced by the boilers is used on-site. Capacities of the 50 wood-fired combustors ranged from 1.28 to 422 million Btus per hour with a mean of 50.6 million btus per hour. Many of the operators contacted during this second survey were better able to accurately describe the quality (moisture content) of fuel used. They were able to identify the hours of boiler operation, and a few operators had modified their boilers over the years. When operators were not able to describe the boiler capacity, the figures from the Montana Department of Health were used for boilers producing more than 5 tons per year of particulate matter. If an operator was unable to express the capacity of a boiler in Btus per hour, we made the conversion based on the information they provided or the following assumptions: hog fuel was 50 percent moisture content; the boiler operated at 70 percent capacity 240 days per year, 8 hours per day; a unit of dry hog fuel was 0.93 oven dry tons. The boiler and fuel capacity is listed as an approximate value if DNRC made the conversions.

These assumptions appear reasonable because this estimate is only 6.48 percent greater than the hog fuel consumption estimates by the Montana Bureau of Business and Economic Research (BBER). The BBER estimates are based on the amount of fuel used to dry or process Montana's lumber, paper, and plywood products, and does not include post and pole, house log, pellet mill operations, and non-wood products industries. This survey occurred during a surplus of hog fuel (July 1 through June 30, 1988), so operators burned hog fuel at a higher than normal rate to get rid of it rather than dispose of the wood waste at a landfill.

Two facilities burning waste wood fuel had cogeneration or parallel generation capabilities. The average annual electrical output from these facilities is approximately 138.6 million kilowatt hours (approximately 14.5 MW of capacity). These facilities consume about 50 percent of all wood waste used in the state on an annual basis. They buy additional electrical power for their operations, but one of them is planning to rebuild a 4.2 MW boiler/generator for additional electric capacity since the hog fuel still presents a disposal problem.

The second highest use of biomass fuel in Montana is the residential consumption of wood for heat. The 380,000 oven-dry tons per year of fuel represent 35.5 percent of all biomass used for energy based on the amount of cords listed in the Pacific Northwest and Alaska Bioenergy Program report on

Estimation of Residential Wood Consumption. One cord corresponds to one oven-dry ton of wood.

This residential wood use amount does not include wood pellets, although most wood pellets in the state are sold for residential use. Approximately 119 tons of pellets are used in Montana institutions. Wood pellet manufacturers use about 11,000 tons per year for process heat and pellet feedstock, representing one percent of the Montana biomass energy use. Four pellet plants operating in Montana plan to market 10,000 tons of pellets in 1988-89 heating season.

Ethanol Fuel Facilities

Ethanol fuel consumed as gasohol represents 1.7 percent of the biomass energy used in Montana. Only one plant still produces fuel ethanol, and it burns waste wood as a boiler fuel. Several other plants that are fired with natural gas, oil, propane, or in one case, straw, are waiting for better grain and alcohol prices before operation can continue. The capacity of the one active alcohol plant is 2,980,000 gallons per year. The production capacity of 3 fuel ethanol plants currently for sale is 2,520,000 anhydrous gallons per year. ALthough the plants do not operate at capacity, they consistently produce enough ethanol to displace 3 to 4 percent of the gasoline used in the state.

Biogas

Five municipalities burn biogas produced from their anaerobic digesters representing 0.3 percent of the biomass energy used in Montana. The biogas is used to fire boilers to heat digesters and also to fuel diesel generators modified with a spark ignition to produce electricity. The Billings and Helena wastewater treatment plants have a combined cogeneration output of 1,644,000 Kwh per year (0.45 MW capacity). These plants use the cooling water from the engines to heat the digesters or pre-heat boiler feed water. They also have the capability to use biogas directly in the boilers. The municipalities financed the biogas facilities in part with funds from the Environmental Protection Agency and the sale of bonds.

MSW, Straw and Cogeneration Facilities

Only one trash-to-energy (MSW) facility is installed in Montana, representing a potential of 0.5 percent of the biomass energy used in Montana. The facility does not currently sell or produce steam by burning trash because the former customer, Burlington Northern Railroad shops, moved out of Livingston, Montana. The trash is still being burned for environmental reasons. The facility is listed because several businesses have expressed interest in using the railroad shops and steam from the facility.

Two commercial straw-fired facilities have operated in Montana. A fuel ethanol plant near Geraldine fires a 1.5 million Btu/hour boiler with straw when operating. Another seasonal demonstration dries corn using straw and stover in a 1.5 million Btu/hour Sukup combustor at the Montana Eastern Agricultural Experiment Station in Huntley. The Sukup combustor dried a corn crop valued at $14,000 in the fall of 1987. Both of these projects were partially funded by the Montana Renewable Energy and Conservation Program.

There is 14 MW capacity of wood-fired parallel or cogenerated electricity and 0.45 MW of biogas-fired electricity in Montana. This amount of energy, representing 140,244,000 kilowatt hours annually, is not considered to displace fossil fuels because of the surplus (hydro) energy in the area. Otherwise this energy would represent an additional 478,650 million Btus of coal-fired electrical production.

ALCOHOL PRODUCTION FACILITIES

AlcoTech
PO Box 154
Ringling, Montana 59642
Contact: Jay Doig, Gordon Doig, (406) 547-2116

Plant Location: on Route 89 near Ringling, Montana
Year Operation Began: 1980 *Construction Costs:*
Funding Sources (Subsidies & Incentives): private

Ownership: private

Primary Biomass Feedstock: wheat
Secondary Biomass Feedstock: corn

Type of Customers: local gas stations, out of state refinery
Proof of Alcohol Produced: 200

Plant Design capacity: 600 HP
- *Heat:* 31 *MMBtu per hour*
- *Steam:* 135 *lbs/hr at* *135* *psig*
- *Electricity:* N/A

Average Plant output:
- *Heat:* 26 *MMBtu per hour*
- *Steam:* *lbs/hr at* *120* *psig*
- *Electricity:* N/A

Biomass Fuel Input: 3.4 tons/hr, (3,672 ODT/yr)
Boiler Fuel: hogged wood waste

End Products:	anhydrous alcohol	*Quantity (per year):*	2,730,000 gal.
By-Products:	DDG	*Quantity (per year):*	3,000 tons
Primary Use:	fuel additive	*Alternative Uses:*	cattle feed

Briefly Describe the System's Operations: The system produces anhydrous alcohol. Hogged fuel fires a boiler and steam from the boiler is used to heat a fermentation vat.

Comments (Major Obstacles, Future Plans): The plant burned, but was rebuilt. System uses a Gen Dry vapor recompression system as part of the distillers grains drying system.

Note, for this directory:
- *MMBtu represents millions of Btus;*
- *lbs/hr means pounds per hour;*
- *Fuel use inside ( ) is estimated by DNRC based on assumptions in text;*
- *ODT represents oven dry tons;*
- *N/A means not applicable; and a*
- *blank indicates that no response was given by the facility*

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BIOGAS

City of Billings
Wastewater Treatment Plant
PO Box 30958
Billings, Montana 59111
Contact: Joe Steiner, (406) 657-8352

Plant Location: Billings, Montana
Year Operation Began: 1985 *Construction Costs:* $5,000,000 total plant
Funding Sources (Subsidies & Incentives): local

Ownership: public

Primary Biomass Feedstock: sewage
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity:
Heat: 4.5 Heat exchanger design capacity *MMBtu per hour*
Steam: N/A *lbs/hr at* ____ *psig*
Electricity: at least twice what they are now producing. ~.26 mw

Average Plant output:
Heat: about 810 *MMBtu* each month
Steam: *lbs/hr at* ____ *psig*
Electricity: 95,000 kwh/month → .13 mw

End Products: biogas *Quantity:* 121,000 ft 3/day (44.1 million ft^3/yr)
By-Products: *Quantity (per year):*
Primary Use: fuel for generator

Briefly Describe the System's Operations: Methane from the digester fires an engine generator. Cooling water from the engine runs through exchangers to extract the heat. The heat is used for the digester and as preheat for the boiler. The plant is producing about $4000 worth of electricity a month and costs roughly $400 a month for operation and maintenance. The electricity is used at the wastewater treatment plant. They are using 95-98 percent of the methane gas produced

Comments (Major Obstacles, Future Plans):

BIOGAS

Bozeman Wastewater Treatment Plant
City of Bozeman
PO Box 640
Bozeman, Montana 59715-0640
Contact: Don Noyes, (406) 586-9159

Plant Location: west of Bozeman, Montana
Year Operation Began: 1969 installed digesters *Construction Costs:*
Funding Sources (Subsidies & Incentives): EPA grant, city and state funding

Ownership: public

Primary Biomass Feedstock: sewage
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity:
Heat: about .48 and .55 *MMBtu per hour*
Steam: *lbs/hr at* 15 *psig*
Electricity: N/A

Average Plant output:
Heat: ranges between 25% and 75% of capacity
Steam: *lbs/hr at* __ *psig*
Electricity: N/A

End Products: biogas *Quantity :* 36,000 ft^3/day (13.1 million ft^3/yr)
By-Products: *Quantity (per year):*
Primary Use: digester heat *Alternative Uses:* building heat

Briefly Describe the System's Operations: The system consists of two boilers: one heats digesters, and the other heats four outside buildings. A portion of the gas is flared.

Comments (Major Obstacles, Future Plans):

Ⓔ

BIOGAS

Helena Wastewater Treatment Plant
City of Helena
316 North Park
Helena, Montana 59623
Contact: Mike Garrity, (406) 442-9920

Plant Location: 1708 Custer Ave East, Helena, Montana
Year Operation Began: 1984 *Construction Costs:* $200,000
Funding Sources (Subsidies & Incentives): EPA grant and revenue bonds

Ownership: public

Primary Biomass Feedstock: sewage
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity: 2.7 million Btu per hour boiler capacity
Heat: 2.5 heat exchanger capacity *MMBtu per hour*
Steam: *lbs/hr at* 15 *psig*
Electricity: 150 kw → .15 mw

Average Plant output:
Heat: *MMBtu per hour*
Steam: *lbs/hr at* ____ *psig*
Electricity: 1,400 kwh daily → .06 mw

End Products: biogas *Quantity (per year):* 19.4 million/yr
By-Products: sludge *Quantity (per year):*
Primary Use: fuel for generator *Alternative Uses:* boiler fuel

Briefly Describe the System's Operations: System consists of a 4 cycle, 8-cylinder, 2,100 cubic inch, V block, water cooled Waukesha engine driving a Keto 150 KW generator. The plant boiler consumes 9,600 ft^3/day of the methane gas. Heat off the engines pre-heat boiler feed water. Biogas can also be burned in the boiler that heats the digester, but boiler tubes stay cleaner if an 80:20 biogas:natural gas mixture is used. Excess biogas (produced during summer) is flared. Sludge is somewhat de-watered and injected into nearby fields.

Comments (Major Obstacles, Future Plans):

BIOGAS

City of Kalispell
Wastewater Treatment Plant
Drawer 1997
Kalispell, Montana 59901
Contact: Don Hultgren, (406) 752-6600

Plant Location: Kalispell, Montana
Year Operation Began: 1985 *Construction Costs:* $2.6 Million total plant
Funding Sources (Subsidies & Incentives): EPA 75%, City Bonds 25%

Ownership: public

Primary Biomass Feedstock: sewage
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity:
- *Heat:* 1.3 *MMBtu per hour*
- *Steam:* *lbs/hr at* 15 *psig*
- *Electricity:* N/A

Average Plant output:
- *Heat:* .072 *MMBtu per hour*
- *Steam:* 1,200 *lbs/hr at* 10 *psig*
- *Electricity:* N/A

End Products: biogas
Quantity : 28,000 ft^3/day (7.3 million ft^3/yr)
By-Products:
Quantity (per year):
Primary Use: heat
Alternative Uses:

Briefly Describe the System's Operations: A Methane fired boiler is used to heat digester and buildings. They use about 6,000 ft^3/day of methane; the rest is flared. The city is saving $500 per month over natural gas purchases, not including maintenance.

Comments (Major Obstacles, Future Plans): Sewer gas is dirty and has occasionally clogged feed lines. Scrubbers have proven too expensive to clean up the gas.

Wastewater Treatment Plant
City of Missoula
201 West Spruce Street
Missoula, Montana 59802
Contact: Tim Hunter, Sewer Division Superintendent, (406) 721-0111

Plant Location: Clark Fork Lane, Missoula, Montana
Year Operation Began: *Construction Costs:* $15,000,000 total plant
Funding Sources (Subsidies & Incentives): EPA, City

Ownership: public

Primary Biomass Feedstock: domestic sewage
Secondary Biomass Feedstock:

Type of Customers: plant serves entire city of Missoula, domestic and industrial users - biogas used on site

Plant Design capacity:
Heat: 5.2 and 2.09 *MMBtu per hour* for two boilers
Steam: *lbs/hr at __ psig*
Electricity: N/A

Average Plant output: in winter, 100% of the larger boiler, in summer, about 90% of smaller boiler capacity only
Heat: *MMBtu per hour*
Steam: *lbs/hr at __ psig*
Electricity: N/A

End Products: biogas *Quantity (per year):* 12.8 million ft^3/yr
By-Products: *Quantity (per year):*
Primary Use: fuel for boilers *Alternative Uses:*

Briefly Describe the System's Operations: Boilers heat digesters and building. The biogas is used to fire one of two boilers, the larger boiler being used in the winter. Hot water from the boilers is used to heat the digesters and plant buildings. About 60 percent of the biogas produced is burned. However, biogas production does not keep up with the fuel demand and they switch to a natural gas back-up system. Because of the problems described below, very little, if any, of the biogas production is being utilized at the present time.

Comments (Major Obstacles, Future Plans): Biogas is very corrosive; the plant has no scrubbers. If carbon dioxide (CO_2) is too high, the biogas will not burn. Biogas storage facilities for digester gas would help solve some of the problem.

WOOD PELLET PLANT

Bitterroot Timber
PO Box 53
Darby, Montana 59829
Contact: Winston Wansrath, Gary Schultz, (406) 821-4428

Plant Location: Darby, Montana
Year Operation Began: 1983 *Construction Costs:* $250,000 including wages
Funding Sources (Subsidies & Incentives): private funds & $110,000 State loan
Ownership: private

Primary Biomass Feedstock: waste wood planner shavings
Secondary Biomass Feedstock: sawdust/house log shavings

Type of Customers: wood pellet stove owners, distributors for resale

Plant Design capacity: 200 HP runs Sprout Waldron machine
Heat: about 2.5 *MMBtu per hour*
Steam: 150 *lbs/hr at* 15 *psig*
Electricity: uses 1130 Kwh, $2,000 to $3,000 to operate

Average Plant output:
Heat: 0.8 *MMBtu per hour*
Steam: 50 *lbs/hr at* 15 *psig*
Electricity: N/A

Biomass Fuel Input Per Year: Boiler burns a wheelbarrow/day, pellet mill used 2,000 Oven Dry Tons in 1987 (estimated 3,500 in 1988)
Mill Design Capacity: 4 tons/hour

Type of combustion system: coal stoker converted to pellets

Percentage of output used at site: pellets are sold

Briefly Describe the System's Operations: A mixture of fir and pine shavings that are not dried are chopped and ground fine. Use of steam to increase feedstock moisture depends on the time of year, weather conditions, and condition of material.

Comments (Major Obstacles, Future Plans): Need good supply (7,000 tons per year) of dry wood waste. Summer/fall operation has lower electric rates and prevents freezing of raw materials. On-site storage areas were expanded to store 600 tons on-site of raw material and 500 tons of bagged pellets. The mill is a Sprout-Waldron. A higher capacity Sprout-Bauer pellet mill should be operating in the fall of 1988

WOOD PELLET PLANT

Blackfoot Forest Products
PO box 188
Lincoln, Montana 59639
Contact: Louie Bouma, (406) 362-4868/362-4222

Plant Location: Lincoln, Montana
Year Operation Began: 1988 *Construction Costs:* $250,000
Funding Sources (Subsidies & Incentives):

Ownership: private

Primary Biomass Feedstock: waste wood, pointer/planner shavings, and sawdust
Secondary Biomass Feedstock: waste sawdust

Type of Customers: wood pellet stove owners, school districts

Plant Design capacity: 1,000 tons of pellets/yr each shift.
Heat: 1.28 *MMBtu per hour*
Steam: 40 *lbs/hr at 10 psig*
Electricity: N/A

Biomass fuel input per year: 3,000 tons/yr.

Type of Combustion System: sawdust suspension

Percentage of output used at site: 30% (pellet feedstock)
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Lodgepole pine planner shavings (10 percent) and Doug Fir sawdust (90 percent) are dried to 10 percent moisture content then ground to a fine sawdust before passing through a Sprout-Bauer pellet mill. The pellets are cooled prior to bagging or storage for bulk sales. Plant is located next to Bouma Post and Pole. The above production is for an 8 hour per day shift, 5 days per week. Production will be increased if demand doubles or triples.

Comments (Major Obstacles, Future Plans): Test runs were made in November, 1988.

WOOD PELLET PLANT

Rocky Mountain Mills
Box 46
Ravalli, Montana 59864

Contact: Allen 'Bud' Zempel, Rte 1, Box 12-A, St. Ignatius, Montana 59865
(406) 745-2492

Plant Location: Ravalli, Montana
Year Operation Began: 1984 *Construction Costs:* $265,000 and additional expansion loan
Funding Sources (Subsidies & Incentives): $105,000 SBA loan

Ownership: private

Primary Biomass Feedstock: waste wood planner shavings
Secondary Biomass Feedstock: sawdust

Type of Customers: wood pellet stove owners, school districts, supermarkets

Plant Design capacity: 5,000 tons of pellets/yr.
Heat: *MMBtu per hour*
Steam: *lbs. of steam*
Electricity: N/A

Biomass Fuel Input Per Year: 1,000 tons/year

Type of combustion system: modified coal stoker (for heat) and uses pellets and floor sweepings.

Percentage of output used at site: N/A
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Fir and Pine (60:40) planner shavings are ground, pelleted, screened, and sacked. Some pellets are sold in bulk using a drive-under bulk storage bin for loading. Tank coolers were installed for pellets.

Comments (Major Obstacles, Future Plans): Need good supply of dry wood waste, about 5,000 dry tons/year. Operate mostly in summer because of material availability. The mill is a modified Sprout-Waldron.

WOOD PELLET PLANT

Westwood Manufacturing
PO Box 1013
251 Arden Drive
Belgrade, Montana 59714
Contact: Win Webb, (406) 388-4047

Plant Location: Belgrade, Montana
Year Operation Began: 1987 *Construction Costs:*
Funding Sources (Subsidies & Incentives): private

Ownership: private

Primary Biomass Feedstock: waste wood - dry sawdust, 60% fir & 40% pine

Type of Customers: residential, institutional

Plant Design capacity: 16-20 tons/day - 5-day week year round
Heat: *MMBtu per hour--one small boiler burns diesel*
Steam: *lbs/hr at* 8 *psig*
Electricity: N/A

Average Plant output: runs 30% of capacity
Heat: *MMBtu per hour*
Steam: *lbs/hr at* ____ *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 4,000 to 5,000 ODT/yr

Type of combustion system: diesel

Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Wood hogged, then pulverized and held in a surge bin before entering a California Pellet Mill-brand mill. The all-wood (no bark) pellets are cooled and sacked.

Comments (Major Obstacles, Future Plans):

COMBUSTION FACILITIES

American Timber Company
PO Box 128
Olney, Montana 59927
Contact: Kurt Larson, (406) 881-2311

Plant Location: Olney, Montana
Year Operation Began: 1946 *Construction Costs:*
Converted 1976
Funding Sources (Subsidies & Incentives): private

Ownership: private

Primary Biomass Feedstock: hogged feed
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity:
Heat: 60 *MMBtu per hour*
Steam: 60,000 *lbs/hr at* 100 *psig*
Electricity: N/A

Average Plant output: 85% of capacity
Heat: *MMBtu per hour*
Steam: 40,000 *lbs/hr at* 90 *psig*
Electricity: N/A

Biomass Fuel Input Per year: 7.5 tons/hr. design capacity, Actual use is 3 ODT/Hr, summer -- 6 ODT/Hr winter (30,200 ODT/Hr to 34,400 ODT/Hr).

Type of combustion system: Wellens fuel cell

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Steam from the boiler is used to heat lumber drying kilns and also provides plant heat. Bunker oil backup.

Comments (Major Obstacles, Future Plans): Operator is looking for new markets for bark sawdust and other potential fuels.

COMBUSTION FACILITIES

Champion Building Products
Drawer 7
Bonner, Montana 59823
Contact: John W. Price, (406) 258-5511

Plant Location: Bonner, Montana
Year Operation Began: 1973 (Plywood plant) *Construction Costs:*
Funding Sources (Subsidies & Incentives): private

Ownership: stockholders

Primary Biomass Feedstock: waste wood
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity:
Heat: 643 *MMBtu per hour*--two boilers total (357 + 286)
Steam: *lbs/hr* at *360* *psig*
Electricity: N/A

Average Plant output: run 70-90% of capacity
Heat: *MMBtu per hour*
Steam: 200,000 and 160,000 *lbs/hr* at *310* *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 57.1 tons/hr: 109,630 Oven Dry Tons/Yr

Type of combustion system: Wood waste is augered into furnace and air injected into bottom of furnace for mid-air (suspension) combustion in the water tube boiler. Sawdust from the sawmill and veneer driers are burned in suspension in the smaller boiler.

Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Hogged fuel fires two boilers which supply steam to heat sawmill, veneer driers, and drying kilns. The larger boiler feeds the plywood operations. Two older boilers and a gas system served as backups, but are no longer in use. Boilers have provisions for higher pressures needed for electric generation if cogeneration or parallel generation becomes economically attractive in the future.

Comments (Major Obstacles, Future Plans): No future plans for expansion.

COMBUSTION FACILITIES

Champion Building Products
PO Box 7789
Missoula, Montana 59807
Contact: Floyd Brady, (406) 721-7980

Plant Location: Missoula, Montana
Year Operation Began: 1971 *Construction Costs:*
Funding Sources (Subsidies & Incentives):

Ownership: stockholders

Primary Biomass Feedstock: hogged fuel
Secondary Biomass Feedstock: sawdust

Type of Customers: self

Plant Design capacity:
Heat: 46 *MMBtu per hour*
Steam: 27,500 *lbs/hr at* *250* *psig*
Electricity: N/A

Average Plant output:
Heat: 32.12 *MMBtu per hour*
Steam: 27,500 *lbs/hr at* *100* *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 4.37 tons/hr design capacity or 3,650 Tons/yr, (1,825 Oven Dry Tons/yr)

Type of combustion system: forced air

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Steam from a single boiler is used in the drying kilns and for heating. A wet scrubber was installed for air pollution control. About half of the waste wood is shipped out.

Comments (Major Obstacles, Future Plans): re-bricked boiler in 1986.

E

COMBUSTION FACILITIES

Champion International
PO Box V-X
Libby, Montana 59923
Contact: Don Daly, (406) 293-4141

Plant Location: Libby, Montana
Year Operation Began: 1922 *Construction Costs:*
Funding Sources (Subsidies & Incentives): private

Ownership: stockholders

Primary Biomass Feedstock: hogged fuel
Secondary Biomass Feedstock:

Type of Customers: self and Pacific Power and Light

Plant Design capacity:
Heat: 565 *MMBtu per hour* total (202 + 255 + 108)
Steam: 150,000 *lbs/hr at* *415* *psig*
150,000 *lbs/hr at* *250* *psig*
Electricity: 12,500 Kw

12.5 mw

Average Plant output:
Heat: 450 *MMBtu per hour*
Steam: 140,000 *lbs/hr at* *415* *psig*
125,000 *lbs/hr at* *250* *psig*
Electricity: roughly 75 million KWH → 8.6 mw

Biomass Fuel Input Per Year: 51.85 Tons/hr. maximum design capacity, (99,550 ODT/yr)

Type of combustion system: 2 older dutch ovens and 1 new spreader stoker

Percentage of output used at site: 8% of electricity
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: System consists of two older boilers modified to run at about twice their ratings of 998 HP and 1265 HP. A newer boiler operates at 140,000 lbs/hr at 400 psi or about 93 percent of design capacity.

Comments (Major Obstacles, Future Plans): No plans for increasing capacity

COMBUSTION FACILITIES

Darby Lumber, Inc.
PO Box 395
Darby, Montana 59829
Contact: Joel Johnstun, (406) 821-3261

Plant Location: Darby, Montana
Year Operation Began: 1968 with present boiler *Construction Costs:*
Funding Sources (Subsidies & Incentives): private

Ownership: stockholders

Primary Biomass Feedstock: planner shavings, sawdust
Secondary Biomass Feedstock: wood chips

Type of Customers: self

Plant Design capacity:
Heat: 44 *MMBtu per hour*
Steam: 25,000 *lbs/hr at* 125 *psig*
Electricity: N/A

Average Plant output: 75%
Heat: *MMBtu per hour*
Steam: *lbs/hr at* 100 *psig*
Electricity: N/A

Biomass Fuel Input Per Year: not able to estimate
(3 Tons/hr or 3,240 ODT/Yr)

Type of combustion system: solid bed grate

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Plant output is used in drying kilns and for heat in buildings. Most of the plant's wood waste by-products are sold to Stone Container and Potlatch.

Comments (Major Obstacles, Future Plans): A study has indicated emissions from the plant's stacks could be reduced by only five percent by installing a catalytic combustor.

COMBUSTION FACILITIES

Flathead Lumber Company
Route 1, Box 43
Polson, Montana 59860
Contact: Joe Brown, (406) 883-5286

Plant Location: On Highway 93 south of Polson, Montana
Year Operation Began: 1981, Boilers from 1940's *Construction Costs:*
Funding Sources (Subsidies & Incentives): private and grant

Ownership: private

Primary Biomass Feedstock: hogged fuel
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity: 2 boilers rated at 180 hp (12 million Btu/hr each)
3 boilers rated at 150 hp (10 million Btu/hr each)
Heat: 54 *MMBtu per hour*
Steam: 25,875 *lbs/hr at* 150 *psig*
Electricity: N/A

Average Plant output: about 3/4 of capacity
Heat: *MMBtu per hour*
Steam: 20,000 *lbs/hr at* 125 *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 6.4 Tons/hr design capacity,
(24,580 Oven Dry Tons/Yr)

Type of combustion system: Dutch ovens
Primary use: heat
Alternative Uses: mechanical power

Percentage of output used at site: 100%

Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: The lumber mill contains five waste wood boilers providing heat and mechanical power to the drying kilns and plant. The mill operates 16 hours per day, averages 240 operating days per year and produces 120,000 board feet of lumber a day. The boilers operate at about 3/4 capacity.

COMBUSTION FACILITIES

Flathead Post and Pole
Star Route, PO Box 13
Dixon, Montana 59831
Contact: Aaron Jones, (406) 246-3591

Plant Location: Dixon, Montana
Year Operation Began: 1977 *Construction Costs:* $1,000,000
Funding Sources (Subsidies & Incentives): private funds, grants, economic development loans

Ownership: public (tribal)

Primary Biomass Feedstock: waste wood
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity:
Heat: 73.5 *MMBtu per hour*
Steam: *lbs/hr at* 150 *psig*
Electricity: N/A

Average Plant output:
Heat: 18.4 *MMBtu per hour*
Steam: *lbs/hr at* 100 *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 6.3 million lbs/yr, 15,000 lbs/hr, run 300-350 hrs/mo, (2,430 ODT/yr)

Type of combustion system: forced air furnace, fuel is blown in

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Boiler provides steam for drying kilns and heat for buildings.

Comments (Major Obstacles, Future Plans): Fuel use may be as high as 9,000 ODT/yr.

COMBUSTION FACILITIES

Glacier Log Homes, Inc.
5560 Highway 935
Whitefish, Montana 59937
Contact: Buck Foster, (406) 862-3562

Plant Location: Whitefish, Montana
Year Operation Began: 1987 *Construction Costs:* $93,250 total
Funding Sources (Subsidies & Incentives):

Ownership: private

Primary Biomass Feedstock: wood waste from log home operation
Secondary Biomass Feedstock: purchased hogfuel

Type of Customers: log home buyers

Plant Design capacity:
  Heat: 1.5 *MMBtu per hour*
  Steam: N/A *lbs/hr at* *N/A* *psig*
  Electricity: uses 220, single phase 14.5 HP/hr.

Average Plant output:
  Heat: 1.2 *MMBtu per hour*
  Steam: N/A *lbs/hr at* *N/A* *psig*
  Electricity:

Biomass Fuel Input Per Year: 14,700 Tons of 6,125 Btus/lb, 30% MC, (10,290 ODT/yr)

Type of combustion system: Ultra Fire waste wood forced-air furnace supplies heat to a heat exchanger coupled to a hot-air dry kiln and dehumidification system.

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Logs are debarked, planed, and loaded into the kiln for drying. The waste wood is conveyed to a 7 x 35 foot storage bin. The furnace takes about 20 hours to reach operating temperature. Another 40 hours are needed to dry the 60,000 BF house log cants from 50 percent to 17 percent moisture content before unloading and shipping them to customers.

Comments (Major Obstacles, Future Plans): Presently controlled by semi-automatic microprocessor based controls, combined with relay control logic. Apple IIE microcomputer capability in future operation. Planing mill burned in July of 1988 so dry kiln is almost entire operation.

COMBUSTION FACILITIES

Ksanka Lumber Company
(Plum Creek Timber Company)
PO Box 28
Fortine, Montana 59918
Contact: Mr. Bill McKinney, (406) 884-4436

Plant Location: Fortine, Montana
Year Operation Began: 1979 *Construction Costs:*
Funding Sources (Subsidies & Incentives):

Ownership: stockholders

Primary Biomass Feedstock: bark
Secondary Biomass Feedstock: waste wood

Type of Customers: none - own use (dry kilns)

Plant Design capacity:
- *Heat:* about 19 *MMBtu per hour*
- *Steam:* 20,000 *lbs/hr at 125 psig*
- *Electricity:* none

Average Plant output:
- *Heat:* 16 *MMBtu per hour*
- *Steam:* 16,000 *lbs/hr at 100 psig*
- *Electricity:* none

Biomass Fuel Input Per Year: 5,230 Oven Dry Tons

Type of combustion system: Wellons Fuel Cell

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: The system is comprised of a 20,000 lb/hr Nebraska Boiler and a Wellons Fuel Cell. We use bark and waste wood hogged for fuel from our sawmill for the boiler fuel, and we use the steam to run the dry kilns and heat the mill.

COMBUSTION FACILITIES

Louisiana - Pacific Corporation
Kentucky Avenue
Deer Lodge, Montana 59722
Contact: Eddy Newman, (406) 846-1600

Plant Location: Deer Lodge, Montana
Year Operation Began: *Construction Costs:*
Funding Sources (Subsidies & Incentives):

Ownership: stockholders

Primary Biomass Feedstock: lodgepole and Douglas fir bark
Secondary Biomass Feedstock: lodgepole and Douglas fir sawdust

Type of Customers: self

Plant Design capacity:
Heat: 32.7 *MMBtu per hour*
Steam: 20,000 *lbs/hr at 125 psig*
Electricity: N/A

Average Plant output:
Heat: 14.69 *MMBtu per hour*
Steam: *lbs/hr at 125 psig*
Electricity: N/A

Biomass Fuel Input Per Year: 9125 units, 22,000 ton/yr at 6,382 BTU/lb, 50% mc (10,820 ODT)

Type of combustion system: forced air

Percentage of output used at site: 75% to 80%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: This system dries our product at the plant site and heats the sawmill during winter.

Comments (Major Obstacles, Future Plans): May provide 2,000 to 4,000 ODT/yr. of similar fuel to state buildings in Warm Springs and/or Galen if the conversion is economical.

COMBUSTION FACILITIES

Louisiana - Pacific Corp.
PO Box 4007
Missoula, Montana 59806

Contact: Wally Christenson, Tom Haugen Plant Engineer, (406) 728-3910

Plant Location: Missoula, Montana
Year Operation Began: 1970 *Construction Costs:* 1/2 million
1981 dust conversion
Funding Sources (Subsidies & Incentives): private

Ownership: stockholders

Primary Biomass Feedstock: dust from sanding operation
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity:
Heat: 55 *MMBtu per hour*
Steam: 42,000 *lbs/hr at* 250 *psig*
Electricity: N/A

Average Plant output:
Heat: *MMBtu per hour*
Steam: 38,000 *lbs/hr at* 250 *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 3.416 Tons/hr maximum design capacity, (3,670 ODT/yr)

Type of combustion system: Guaranteed Performance cyclone burner

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: A dust-fired cyclone burner provides steam for a hot press and for building heat.

Comments (Major Obstacles, Future Plans):

COMBUSTION FACILITIES

Mineral County Library and Museum
PO Box 550
301 2nd Ave. East
Superior, Montana 59872
Contact: Robert Crabb, (406) 822-4541

Plant Location: 301 2nd Ave. East
Year Operation Began: 1983 *Construction Costs:*
Funding Sources (Subsidies & Incentives):

Ownership: public

Primary Biomass Feedstock: wood pellets
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity:
Heat: *MMBtu per hour*
Steam: *lbs/hr* at ___ *psig*
Electricity: N/A

Average Plant output:
Heat: *MMBtu per hour*
Steam: *lbs/hr* at ___ *psig*
Electricity:

Biomass Fuel Input Per Year: 32-34 Tons 8,000 BTU's/lb

Type of combustion system: 1940 coal grate furnace

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: System had used coal and started burning wood pellets the winter of 83/84

Comments (Major Obstacles, Future Plans): Coal firing produced a 5-gallon bucket of ash every day or two. Brown pellets produce a five gallon bucket of ash every 6 weeks and the Darby (all-wood) pellets every 9 weeks. Pellets burn cleaner than coal and efficiency could be improved if a regular pellet burner were used. The county would like to install a more efficient pellet burner the boiler, but everything is still on hold as of July 14, 1988.

COMBUSTION FACILITIES

Missoula White Pine & Sash
PO Box 7009
Missoula, Montana 59807
Contact: Robert (Bob) Blanchard, (406) 720-4010

Plant Location: Missoula, Montana
Year Operation Began: 1920 *Construction Costs:*
1965 - boilers installed
Funding Sources (Subsidies & Incentives): private

Ownership: stockholders

Primary Biomass Feedstock: hogged fuel
Secondary Biomass Feedstock: sawdust

Type of Customers: self

Plant Design capacity:
Heat: 37 *MMBtu per hour*
Steam: 40,000 *lbs/hr at 150 psig*
Electricity: N/A

Average Plant output:
Heat: *MMBtu per hour*
Steam: 36,000 *lbs/hr at 150 psig*
Electricity: N/A

Biomass Fuel Input Per Year: 3.08 Tons/hr maximum design capacity,
(3,330 ODT/yr)
Type of combustion system: HRT boiler cyclone firebox

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Two boilers provide heat to buildings and drying kilns as well as steam to the shotgun. There is a diesel backup system.

Comments (Major Obstacles, Future Plans):

Montana Southern Agricultural Research Center
748 Railroad Highway
Huntley, Montana 59037
Contact: Dr. Gil Stalknecht, (406) 348-3400

Plant Location: Huntley, Montana
Year Operation Began: 1983 *Construction Costs:* $32,883
(biomass fuel added $15,000 to above)
Funding Sources (Subsidies & Incentives): DNRC Renewable Energy and Conservation grants ($64,000-1983, $18,056-1984 for construction and research)

Ownership: public

Primary Biomass Feedstock: cobs and stover
Secondary Biomass Feedstock: straw, wood chips, propane

Type of Customers: general public, local farmers

Plant Design capacity:
Heat: 1.9 *MMBtu per hour* Sukup furnace
Steam: N/A *lbs/hr at ____ psig*
Electricity: N/A

Biomass Fuel Input Per Year: 3.08 Tons/hr maximum design capacity, (8 ODT/yr of straw)
Type of combustion system: Incinerator

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: A grain drying bin is loaded with corn to a depth of 4 to 5 feet (31 feet in diameter) 1,000 bushels/hour. Stover (stalks and leaves) and cobs from forage wagons or large bales of straw are dumped onto a bale feeder with a walking-floor conveyor. The feeder has spikes to grab small clumps of biomass to feed the fuel auger of the Sukup forced-draft combustor. The fuel fed through the bottom of the combustor is controlled by drying temperature--a higher temperature needs more fuel. The combustor exhaust gases (at 2,000 F) are blown through a heat exchanger. Ambient air is sucked through the heat exchanger by a 20 HP fan and tempered with additional ambient air to reach a drying temperature of 120 to 160 F before entering the drying bin. The grain is dried to 14 percent moisture (from 25 percent) in about 6-8 hours.

Comments (Major Obstacles, Future Plans): A temperature-controlled sprinkler was installed on the auger to reduce burn-back from the furnace. An additional roller support bearing was added to one end of the auger to reduce and clear clogs from feeding straw. A wire cover was made for the fuel auger to prevent large amounts of biomass from falling into (and clogging) the fuel auger. Ambient temperature must be above 20 F to get effective drying in one day.

COMBUSTION FACILITIES

Northern Cheyenne Pine Co.
PO Box 627
Ashland, Montana 59003
Contact: Lee Erickman, (406) 784-2367

Plant Location: east side of Ashland, Montana
Year Operation Began: April 1988 *Construction Costs:*
Funding Sources (Subsidies & Incentives):

Ownership: private

Primary Biomass Feedstock: hog fuel
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity: 700 Hp
Heat: 47 *MMBtu per hour*
Steam: 40,000 *lbs/hr at* 15 *psig*
Electricity: N/A

Average Plant output: not yet determined
Heat: *MMBtu per hour*
Steam: *lbs/hr at* ____ *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 6,736 lb/hr maximum design rate,
unknown annual fuel
(estimated at 8,100 ODT/Yr.)

Type of Combustion System: fluidized bed combustor
Percentage of output used at plant: 100%

Briefly Describe the System's Operations: TNC Lumber, Inc., was purchased in 1987 by local interests and re-equipped for lumber production. The wood-fired boiler provides heat to the dry kilns and heats the plant in the winter.

Comments (Major Obstacles, Future Plans): A forest fire in August 1988 destroyed over 130 million board feet of timber which was part of the mill's resources. The mill operated adjacent to the Northern Cheyenne Indian Reservation--a Class 1 air quality area.

COMBUSTION FACILITIES

Park County Solid Waste Recovery System
Park County Commissioners
414 East Callendar
Livingston, Montana 59047
Contact: Jim Hunt, (406) 222-6120 ext 226

Plant Location: Livingston, Montana
Year Operation Began: 1982 *Construction Costs:* $1,300,000
Funding Sources (Subsidies & Incentives): revenue bond funding

Ownership: public

Primary Biomass Feedstock: county garbage, trash, and occasionally wood chips

Type of Customers: railroad repair shop

Plant Design capacity: 72 tons per day
Heat: 17.1 *MMBtu per hour* each incinerator
Steam: 10,000 *lbs/hr at* 150 *psig*
Electricity: N/A

Average Plant output: 38 tons per day
Heat: *MMBtu per hour*
Steam: *lbs/hr at ____ psig*
Electricity:

Briefly Describe the System's Operations: Trash dumped on the tipping floor has large non-combustible items removed, such as 5 gallon cans and refrigerators. One of two loading floors are loaded with trash by a small front end loader, then lowered and dumped into the starved-air combustion chamber of the Consumat incinerator combustor (1350 F). The hot gases pass to a secondary combustion chamber (1800 F) with a natural gas assist to reach temperature. The hot gases can either pass through the heat recovery section of a boiler, or be exhausted up the stack. When produced, up to 10,000 lbs per hour 150 psi steam can be piped 225 feet to the Burlington Northern locomotive repair shops.

Comments (Major Obstacles, Future Plans): The incinerator was built to end wind dispersion of trash from the city/county landfill. To pay off the construction bonds, steam was produced and sold to Burlington Northern (BN). But BN's summer steam needs were less than expected, and seasonal variations in the volume of fuel available led to a low economic return. BN closed its Livingston shops in 1975. Montana Rail Link sponsored the Montana Rebuild Center (MRC) at the Livingston shops. MRC received an $8 million loan through the Montana Economic Development Board for the Livingston shops in October 1988. MRC is considering purchase of the steam.

COMBUSTION FACILITIES

Plum Creek Timber Company
PO Box 325
Belgrade, Montana 59714
Contact: Gail Freemont, (406) 388-4221

Plant Location: Belgrade, Montana
Year Operation Began: 1983 *Construction Costs:*
1971 boiler's installation date
Funding Sources (Subsidies & Incentives):

Ownership: stockholders

Primary Biomass Feedstock: bark
Secondary Biomass Feedstock: sawdust

Type of Customers: self

Plant Design capacity:
Heat: 33 *MMBtu per hour* (20.8 + 12.2)
Steam: 25,000 *lbs/hr at* *100* *psig*
Electricity: N/A

Average Plant output:
Heat: 21.07 *MMBtu per hour*
Steam: 17,806 *lbs/hr at* *65* *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 14,850 units - 200 ft^3/unit, not bone dry,
design rate 2.803 tons/hr
(17,820 ODT/yr)

Type of combustion system: Dutch ovens, 256 hp Wellons and a 150 hp HRT

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Two boilers provide heat for drying kilns and steam heaters in sawmill.

Comments (Major Obstacles, Future Plans): Estimated 150,000,000 lbs/steam used per year, 24 hrs/day. The boilers are shutdown an average of two weeks per year.

COMBUSTION FACILITIES

Plum Creek Timber Company
PO Box 160
Columbia Falls, Montana 59912
Contact: Dan McCormick, K. R. Hamman, (406) 892-2141

Plant Location: Columbia Falls, Montana
Year Operation Began: 1974 *Construction Costs:*
Funding Sources (Subsidies & Incentives):

Ownership: stockholders

Primary Biomass Feedstock: sander dust
Secondary Biomass Feedstock: hogged wood, bark, sawdust, shavings

Type of Customers: lumber, plywood, fiberboard manufacturing

Plant Design capacity:
- *Heat:* 4.51 *MMBtu per hour*
- *Steam:* 120,000 *lbs/hr at 300 psig*
- *Electricity:* N/A

Average Plant output:
- *Heat:* 3.17 *MMBtu per hour*
- *Steam:* 96,000 *lbs/hr at 275 psig*
- *Electricity:* N/A

Biomass Fuel Input Per Year: 74,500 Tons - 6,500 BTU's/lb,
(55,875 Oven Dry Tons/Yr)

Type of combustion system: Dutch ovens

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Steam is used for dry kilns and mechanical power.

Comments (Major Obstacles, Future Plans):

COMBUSTION FACILITIES

Plum Creek Timber Company
PO Box 188
Pablo, Montana 59855-0188
Contact: John Starner, (406) 892-4351

Plant Location: Pablo, Montana
Year Operation Began: 1958 *Construction Costs:* Unknown
Funding Sources (Subsidies & Incentives):

Ownership: stockholders

Primary Biomass Feedstock: wood shavings
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity:
Heat: 29.6 *MMBtu per hour*
Steam: 20,000 *lbs/hr at* *150* *psig*
Electricity: N/A

Average Plant output:
Heat: 22.2 *MMBtu per hour*
Steam: 16,000 *lbs/hr at* *125* *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 13,149 Tons - 7,400 BTUs/lb, (11,570 Oven Dry Tons)
Type of combustion system: air induction fire box

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: The shavings-fired boiler operates four drying kilns and provides some heat for three buildings.

Comments (Major Obstacles, Future Plans): A secondary oil-fired boiler is used as a back up system when the primary boiler is cleaned or repaired.

COMBUSTION FACILITIES

Pyramid Mountain Lumber Company
PO Box 20
Seeley Lake, Montana 59836
Contact: Bob Cook, (406) 677-2201

Plant Location: Seeley Lake, Montana
Year Operation Began: 1949 and 1979 for boilers
Construction Costs: $250,000 for boiler

Funding Sources (Subsidies & Incentives): private

Ownership: private

Primary Biomass Feedstock: hogged fuel (mostly bark and sawdust)
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity:
Heat: 11.9 *MMBtu per hour* (6.6 + 5.3)
Steam: 10,000 *lbs/hr at* *100* *psig*
Electricity: N/A

Average Plant output:
Heat: 11.9 *MMBtu per hour*
Steam: 10,000 *lbs/hr at* *100* *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 11,138 Tons wet (5,570 ODT/yr)
Type of combustion system: 160 bhp Wellens fuel cell, and a 200 bhp under-fired grate boiler

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Boiler provides heat for drying kilns and steam heaters in buildings.

Comments (Major Obstacles, Future Plans): Maximum capacity has been reached for present boiler. Wet fuel lowers output at times. Planning to expand with a new 500 Bhp boiler. Operator is looking for additional hog fuel markets.

COMBUSTION FACILITIES

St. Ignatius Elementary School
PO Box 400
St. Ignatius, Montana 59865
Contact: Roy Martin, Maintenance Supervisor, (406) 745-2971

Plant Location: St. Ignatius, Montana
Year Operation Began: 1982 *Construction Costs:* $10,000
wood conversion $2,400
Funding Sources (Subsidies & Incentives): School District Funds

Ownership: public (tribal)

Primary Biomass Feedstock: wood pellets
Secondary Biomass Feedstock: sunflower seed pellets

Type of Customers: self

Plant Design capacity: 75 HP
Heat: 2.51 *MMBtu per hour*
Steam: *lbs/hr at* 15 *psig*
Electricity: N/A

Average Plant output:
Heat: 0.357 *MMBtu per hour*
Steam: *lbs/hr at* 8 *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 65 tons/yr

Type of combustion system: Stoker, conversion from oil burner

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Steam from the boiler flows to a heat exchanger and then to hot water heaters used in the building. The boiler burns wood pellets. Original consumption was 120 tons per year, but a time clock and other energy conservation measures, including a building expansion, have decreased consumption to 65 tons per year.

Comments (Major Obstacles, Future Plans): May have to convert the high school to a wood pellet system in the next years to save money.

COMBUSTION FACILITIES

St. Labre Mission School
PO Box 48
Ashland, Montana 59003
Contact: Brother Paul Coourchaine, (406) 784-2746

Plant Location: Ashland, Montana
Year Operation Began: 1988 *Construction Costs:*
Funding Sources (Subsidies & Incentives): retrofit of some buildings was partially paid by US DOE Institutional Building Program

Ownership: private

Primary Biomass Feedstock: hogged fuel
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity: two-350 Hp boilers
Heat: 16.7 *MMBtu per hour* each
Steam: 12,000 *lbs/hr at* 15 *psig* each
Electricity: N/A

Average Plant output:
Heat: *MMBtu per hour*
Steam: *lbs/hr at* ____ *psig*
Electricity: N/A

Biomass Fuel Input Per Year: Maximum design capacity - 3,939 lbs/hr each (estimated 3,700 to 7,000 ODT/yr)

Type of Combustion System: Fuel is blown into combustor for mid-air combustion. Propane is the back-up fuel.

Briefly Describe the System's Operations: System heats a mission school complex during winter (October through May) and provides heat for absorption chillers during the summer. Hog fuel is supplied by Northern Cheyenne Pine Co. for the next 20 years.

Comments (Major Obstacles, Future Plans):

COMBUSTION FACILITIES

Stolze - Conner Lumber Company
PO Box 415
Darby, Montana 59829
Contact: Remington Kuhrt, (406) 821-3241

Plant Location: Darby, Montana
Year Operation Began: *Construction Costs:*
Funding Sources (Subsidies & Incentives):

Ownership: private

Primary Biomass Feedstock: shavings, dried and hogged
Secondary Biomass Feedstock: N/A

Type of Customers: self

Plant Design capacity: 700 HP
Heat: 20 *MMBtu per hour*
Steam: 20,000 *lbs/hr at* 150 *psig*
Electricity: N/A

Average Plant output: derated but unknown amount
Heat: *MMBtu per hour*
Steam: *lbs/hr at* ___ *psig*
Electricity:

Biomass Fuel Input Per Year: 3,000 units, 7,400 BTU's/lb,
3 tons/hr maximum design rate;
(3,600 ODT/yr)

Type of combustion system: McConner burner

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Shavings from planer go to silo, then hammer hog. Granulated shavings go to silo and then to the feeder and burner. The system is very simple, clean, and efficient.

Comments (Major Obstacles, Future Plans): Currently drying 40 million BF of lumber products. May put in bigger burner if needed. May hog and powder dry planer trim blocks for fuel if needed. Upgrading kiln controls for efficiency.

COMBUSTION FACILITIES

F.H. Stolze Land & Lumber Company .
PO Box 1429
Columbia Falls, Montana 59912
Contact: Rusty Beck, (406) 892-3252

Plant Location: 3 miles West of Columbia Falls, Montana
Year Operation Began: 1929 *Construction Costs:*
Funding Sources (Subsidies & Incentives): private

Ownership: private

Primary Biomass Feedstock: sawdust
Secondary Biomass Feedstock:

Type of Customers: self

Plant Design capacity: 700 HP total of five boilers,
two-200 bhp boilers and three-100 bhp boilers
Heat: 50 *MMBtu per hour*
Steam: 39,000 *lbs/hr at* 120 *psig*
Electricity: N/A

Average Plant output:
Heat: *MMBtu per hour*
Steam: 35,000 *lbs/hr at* 110 *psig*
Electricity: N/A

Biomass Fuel Input Per Year: 3.3 Tons/day design capacity,
four 5-7 units/hr, 23%-50% moisture;
(3,560 to 5,760 ODT/yr)

Type of combustion system: HRT Boiler with dutch oven

Percentage of output used at site: about 25%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Steam from the five boilers is used in the kilns for heat in the buildings, and one of main head saws has a steam shotgun.

Comments (Major Obstacles, Future Plans): Eventually will install a new system with more efficient boiler

E

COMBUSTION FACILITIES

Stone Container Corporation
Drawer D
Frenchtown, Montana 59834
Contact: Dave Stengel, (406) 626-4451

Plant Location: Frenchtown, Montana
Year Operation Began: 1963 *Construction Costs:*
Funding Sources (Subsidies & Incentives): private

Ownership: stockholders
Primary Biomass Feedstock: hogged fuel
Secondary Biomass Feedstock: bark

Type of Customers: self

Plant Design capacity:
Heat: 578 *MMBtu per hour* (156 + 422)
Steam: 400,000 *lbs/hr at* *600* *psig* from 2 boilers (150,000 + 350,000)
Electricity: 6.0 million KWH per month (10 MW capacity)

Average Plant output:
Heat: about 488 *MMBtu per hour*
Steam: *lbs/hr at* *600* *psig*
Electricity: 5.3 million KWH/mo → 7.4 mw

Biomass Fuel Input Per Year: 373,640 Tons, 8,800 BTU's/lb,
design rate - 62.7 Tons/hr;
(235,400 ODT/yr)

Type of combustion system: The smaller boiler is a hogged fuel fixed-bed, mid-air combustion Cohen burner. The larger boiler is a waste fuel gun-type arrangement with a ring-fired gas burner that can be switched to oil and a traveling grate for solids.

Are you using coal/wood combination fuel? No
Percentage of output used at site: 100%

Briefly Describe the System's Operations: System consists of a hog fuel boiler and a waste fuel boiler. They also have electrical generating capability that provides 10-12 percent of the plants electrical requirements.

Comments (Major Obstacles, Future Plans): May try to optimize electrical production as the price of electricity goes up. Plan to rebuild and operate a 4.2 MwH turbine generator that is presently disabled, but on site.

COMBUSTION FACILITIES

Thompson River Lumber, Inc.
PO Box 338
Kalispell, Montana 59901
Contact: Roger Clavidge, (406) 755-9166 -OR- Joe Saul, (406) 827-4311

Plant Location: Thompson Falls, Montana
Year Operation Began: 1943 *Construction Costs:*
Funding Sources (Subsidies & Incentives):

Ownership: private

Primary Biomass Feedstock: hogged wood
Secondary Biomass Feedstock: pulverized fuel wood

Type of Customers: self

Plant Design capacity:
Heat: 24 *MMBtu per hour* for two 125 Bhp boilers each derated to 100 Bhp)
Steam: 7,500 *lbs/hr* at *600 psig* each
Electricity: N/A

Average Plant output:
Heat: *MMBtu per hour*
Steam: 12,000 to 15,000 *lbs/hr* at *80 psig*
Electricity: N/A

Biomass Fuel Input Per Year: 1.906 Tons/hr design capacity for 2 boilers; (7,300 to 9,100 ODT/yr in 1987/8, 45%MC)

Type of combustion system: Dutch Ovens

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Bark and sawdust from the sawmill is used to fuel two dutch-oven boilers.

Comments (Major Obstacles, Future Plans): The Flodin Lumber and Mfg. Co. was sold to Thompson River Lumber (LHC, Inc.) in Kalispell. The present boilers are to be upgraded or replaced. Operators are looking for additional hog fuel markets in the area, but cannot justify cogeneration at this time. (The 1986 operation used only 4,104 ODT/yr).

COMBUSTION FACILITIES

W-I Forest Products, Inc.
PO Box 368
Thompson Falls, Montana 59773
Contact: Cal Troutman, (406) 827-3511

Plant Location: 1 Mile East of Thompson Falls, Montana
Year Operation Began: 1953 *Construction Costs:*
Funding Sources (Subsidies & Incentives):

Ownership: stockholders

Primary Biomass Feedstock: sawdust
Secondary Biomass Feedstock: shavings

Type of Customers: self

Plant Design capacity: 750 bhp total
HRT Boilers #1/100hp, #2/100hp, #3/150hp, and (water tube) #4/400hp
Heat: 25.12 *MMBtu per hour*
Steam: 84,000 *lbs/hr at 100 psig*
Electricity: N/A

Average Plant output:
Heat: 12.25 *MMBtu per hour*
Steam: 84,000 *lbs/hr at 100 psig*
Electricity: N/A

Biomass Fuel Input Per Year: 5,292 Tons, 5500 BTU's/lb; (2,650 Oven Dry Tons)
Type of combustion system: Dutch ovens; three H.R.T. Boilers (Fire Tube) and water tube boiler

Percentage of output used at site: 100%
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Steam power, shot gun, log loader, and provides heat for five drying kilns (two singles & three doubles).

Comments (Major Obstacles, Future Plans): no sales program exists to sell surplus hog fuel because it is too far to haul to any company that would buy.

BIOENERGY FACILITIES
NOT CURRENTLY OPERATING

ALCOHOL PRODUCTION FACILITIES

AE Montana
Route 2, Box 125
Manhattan, Montana 59741

NO LONGER IN OPERATION
Contact: Previously (406) 282-7217
or First Citizen's Bank of Bozeman

Plant Location: Amsterdam, Montana
Year Operation Began: 1981 *Construction Costs:* $2,100,000
end 1987
Funding Sources (Subsidies & Incentives): DNRC and SBA loans, local and out-of-state financing

Ownership: private

Primary Biomass Feedstock: wood pellets (boiler), barley for ethanol
Secondary Biomass Feedstock:

Type of Customers: gasoline distributors, dairy farms

Plant Design capacity:
Heat: 24.6 *MMBtu per hour* (735 BHP)
Steam: *lbs/hr at* 150 *psig*
Electricity:

Average Plant output:
Heat: 4.5 *MMBtu per hour*
Steam: *lbs/hr at* 75 *psig*
Electricity:

End Products: 200 proof fuel ethanol *Quantity per year:* 1.6 million (cap)
By-Products: Wet/dry distillers grain *Quantity per year:* 900 tons (capacity)
Primary Use: *Alternative Uses:*

Briefly Describe the System's Operations: Combustor was a Aqua-Chem suspension burner. Backup fuel for boiler is coal, propane, or natural gas.

Comments (Major Obstacles, Future Plans): The plant did not operate for most of 1986. Boiler emissions equipment was modified to burn wood pellets. Plant was cited for burning coal. Management is being reorganized.

ALCOHOL PRODUCTION FACILITIES

Agri-Fuels
PO Box 2134
Polson, Montana

NOT IN OPERATION, Stored in operational condition
Contact: Dan Miles, (406) 883-6102

Plant Location: Polson, Montana
Year Operation Began: 1984 *Construction Costs:* $98,000
Funding Sources (Subsidies & Incentives): private and DNRC grant

Ownership: private

Primary Biomass Feedstock: grain
Secondary Biomass Feedstock: potatoes

Type of Customers: gasoline distributors
Fuel Used in Distillation Process: No. 2 oil fuel
Proof of Alcohol Produced: 180

Plant Design capacity:
Heat: *MMBtu per hour* (50 bhp)
Steam: 1,725 *lbs/hr* at 150 *psig*
Electricity: N/A

Average Plant output:
Heat: *MMBtu per hour*
Steam: *lbs/hr* at 20 *psig*
Electricity: N/A

End Products: ethanol *Quantity (per year):* 200,000 gal.
By-Products: distillers grain *Quantity (per year):*
Primary Use: fuel *Alternative Uses:* cattle feed

Briefly Describe the System's Operations: The portable plant consists of a York Shipley boiler, a hammer mill for grinding potatoes, and a portable alcohol still. A molecular sieve is needed to produce pure ethanol.

Comments (Major Obstacles, Future Plans): Mr. Miles was unable to secure funding for plant start-up and the plant has been moth balled until it can be sold or funding can be secured. One thought is to combine plant operation with a pellet mill that would utilize the distillers grain.

ALCOHOL PRODUCTION FACILITIES

Bronec Fuel
Box 23
Geraldine, Montana 59446

NOT IN OPERATION (Stored in Operational Condition)
Contact: Larry Bronec, (406) 737-4325

Plant Location: Geraldine, Montana
Year Operation Began: 1982 *Construction Costs:* $175,000
Funding Sources (Subsidies & Incentives): DNRC grant - $37,000 Montana Department of Agriculture loan - $20,000

Ownership: private

Primary Biomass Feedstock: barley
Secondary Biomass Feedstock: wheat

Type of Customers: self and gasoline suppliers
Fuel Used in Distillation Process: chopped straw at 7,000 Btu/lb, 440 ton per year when operating
Proof of Alcohol Produced: 200

Plant Design capacity: 50 hp-Straw fired vortex suspension burner
Heat: 1.5 *MMBtu per hour*
Steam: *lbs/hr at* 25 *psig*
Electricity: N/A

Average Plant output:
Heat: 1.3 *MMBtu per hour*
Steam: *lbs/hr at* 15 *psig*
Electricity: N/A

End Products: anhydrous alcohol *Quantity (per year):* 73,000 gal.
By-Products: distillers grain *Quantity (per year):*
Primary Use: ethanol fuel *Alternative Uses:* cattle feed

Briefly Describe the System's Operations: The system consists of a chopped-straw boiler providing process heat to an alcohol production facility.

Comments (Major Obstacles, Future Plans): Cost of grain production has made alcohol fuel uneconomical to produce, so plant is shut down.

ALCOHOL PRODUCTION FACILITIES

Sage 'n Cedar
2221 Trails End Road
Billings, Montana 59106

NOT IN OPERATION
Contact: Harley Hogeland, (406) 657-6266

Plant Location: Terry, Montana
Year Operation Began: 1984 *Construction Costs:* Around $225,000
Funding Sources (Subsidies & Incentives): DNRC loan and local lending

Ownership: stockholders

Primary Biomass Feedstock: barley
Secondary Biomass Feedstock:

Type of Customers: fuel
Fuel Used in Distillation Process: propane in a coal boiler
Proof of Alcohol Produced: 199.2

Plant Design capacity: 50hp
Heat: *MMBtu per hour*
Steam: *lbs/hr at* ____ *psig*
Electricity:

Average Plant output: roughly 15hp
Heat: *MMBtu per hour:*
Steam: *lbs/hr at* ____ *psig:*
Electricity:

End Products: fuel alcohol *Quantity (per year):* 500 gal/day
By-Products: stillage *Quantity (per year):*
Primary Use: fuel *Alternative Uses:* cattle feed

Briefly Describe the System's Operations: The system includes a 50hp boiler, distilling vats, and molecular sieve. This operation was never in full production. It was initially fired with propane but the goal was to use coal for boiler fuel.

Comments (Major Obstacles, Future Plans): The plant has been shut down since fall of 1985. The stockholders are seeking investment capital in order to resume operations.

ALCOHOL PRODUCTION FACILITIES

Southwest Alcohol Producers
PO Box 791
Dillon, Montana 59725

NOT IN OPERATION
Contact: Don Harrington, (406) 683-6113

Plant Location: Dillon, Montana
Year Operation Began: 1985 *Construction Costs:* $825,000
Funding Sources (Subsidies & Incentives): State loans totaling $450,000

Ownership: private

Primary Biomass Feedstock: wheat, milo or wheat/barley combination
Secondary Biomass Feedstock: NA

Type of Customers: feedlot and gasoline distributors
Fuel Used in Distillation Process: natural gas
Proof of Alcohol Produced: 200

Plant Design capacity: two boilers of 750,000 Btu/hr each
Heat: *MMBtu per hour*
Steam: *lbs/hr at* 15 *psig*
Electricity:

Average Plant output: NA
Heat: *MMBtu per hour*
Steam: *lbs/hr at* 15 *psig*
Electricity:

End Products: alcohol
By-Products: distillers grain
Primary Use: gasoline additive

Quantity (per year): 414,000 gallons
Quantity (per year): 4,380,000 lbs.
Alternative Uses: livestock feed (distillers grain)

Briefly Describe the System's Operations: The plant is a modified Harvest Fuel model 1651 located in an agricultural complex including a grain roller mill, hay chopping area, and a 7,500-head cattle feedlot. The plant includes 30 process tanks, a distillation column and condenser, 3 solid separator systems, and 2 boilers.

Comments (Major Obstacles, Future Plans): Feedstocks other than soft white wheat can be used after the system was modified. Plant is not operating since February of 1987 due to refinancing of the cattle feedlot.

BIOGAS

C E Ranch
Route 3, Box 461
Conrad, Montana 59425

NOT IN OPERATION
Contact: David Oien, (406) 278-3384

Plant Location: west and north of Conrad, Montana
Year Operation Began: 1982 installed digesters *Construction Costs:* $180,000
Funding Sources (Subsidies & Incentives): private funds and a $95,000 state grant

Ownership: private

Primary Biomass Feedstock: feedlot manure
Secondary Biomass Feedstock: alcohol mash

Type of Customers: self

Plant Design capacity: 10 bhp
Heat: *MMBtu per hour*
Steam: lbs/hr at 15 *psig*
Electricity: N/A

Average Plant output:
Heat: *MMBtu per hour*
Steam: lbs/hr at __ *psig*
Electricity:

End Products: biogas *Quantity :* 10,000 ft^3/day (3.6 million ft^3/yr)
By-Products: fertilizer *Quantity (per year):*
Primary Use: digester heat *Alternative Uses:* alcohol plant and greenhouse building heat

Briefly Describe the System's Operations: The system consists of two digesters under a solar greenhouse (24 x 60 ft.). The digesters were to be fed cattle manure and spent beer from a 200 gallon per day alcohol plant. The digesters use a plug flow process designed by L. John Fry and others. Biogas is stored in one of 6 10-foot diameter floating tanks to be used for the small boiler and possibly a small engine generator for electric production. The boiler will provide heat to the digesters, greenhouse, and alcohol plant.

Comments (Major Obstacles, Future Plans): The digesters have not operated as of October 1988, but the greenhouse successfully produces commercial bedding plants. The state grant was only for the construction of the digesters. Delayed approval of the digester design by the conservation service caused cost overruns and added delays. The engine generator portion of the project was dropped because of the low cost of electricity in the area. Oil prices have continued to fall making the alcohol plant uneconomical as well.

COMBUSTION FACILITIES

Brand S Lumber
PO Box 1033
Livingston, Montana 59047

NOT IN OPERATION
Contact: Jess Perry, (406) 222-3360

Plant Location: Livingston, Montana
Year Operation Began: *Construction Costs:*
Funding Sources (Subsidies & Incentives):

Ownership: private

Primary Biomass Feedstock:
Secondary Biomass Feedstock:

Type of Customers:

Plant Design capacity:
Heat: MMBtu per hour
Steam: lbs/hr at _N/A_ *psig*
Electricity:

Average Plant output:
Heat: MMBtu per hour
Steam: lbs/hr at _N/A_ *psig*
Electricity:

End Products: N/A *Quantity (per year):*
By-Products: N/A *Quantity (per year):*
Primary Use: N/A *Alternative Uses:*

Briefly Describe the System's Operations: Not in operation at this time (July, 1988). Does not look as if pellet plant will be built.

Comments (Major Obstacles, Future Plans): The wood waste is now sent out and a mountain of sawdust is piling up. A pellet mill does not seem economical, but the sawdust may be hauled to the pellet mill in Lincoln.

WOOD PELLET PLANT

Mountain Energy Pellet Plant
PO Box 3686
Bozeman, Montana 59712

Contact: NO LONGER OPERATING
Mr. Bruha of the First Security Bank of Livingston

Plant Location: Livingston, Montana
Year Operation Began: 1983 *Construction Costs:* $1.9 Million
Funding Sources (Subsidies & Incentives): SBA loan takeover of Presto-Log TM plant, $115,000 from DNRC, self

Ownership: private

Primary Biomass Feedstock: hogged wood waste
Secondary Biomass Feedstock:

Type of Customers: wood pellet stove owners, some schools and small businesses

Plant Design capacity: NA
Heat: MMBtu per hour
Steam: lbs/hr at ____ psig
Electricity:

Biomass Fuel Input Per Year: 52,000 ODT Tons for pellets 8,100-9,600 Btus/lb

Type of combustion system: dryer uses natural gas, dryer is 1.6 x 10^6 BTU/hr.

Percentage of output used at site:
Are you using coal/wood combination fuel? No

Briefly Describe the System's Operations: Waste wood from a lumber mill was pelletized. Pellets are sold to dealers mainly in Montana.

Comments (Major Obstacles, Future Plans): The costs of shipping the finished product on ICC licenced carriers is substantial. The producer may be forced to become its own shipping company. Operation has ceased because could not hold major industrial users year round. The plant's insurance company left the state and a new one demands newer safety equipment before operation resumes. The owner was unable to arrange for financing the improvements. Parts of the operation were sold to a pellet company in Idaho.

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